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**A PROFESSIONAL MANPOWER BULLETIN**

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**EMPLOYMENT OUTLOOK  
FOR PROFESSIONAL PERSONNEL  
IN SCIENTIFIC AND  
TECHNICAL FIELDS  
1960-1962**

**BULLETIN No. 8**

**DECEMBER 1960**

**ECONOMICS AND RESEARCH BRANCH  
DEPARTMENT OF LABOUR  
OTTAWA**



### **Professional Manpower Bulletin Series**

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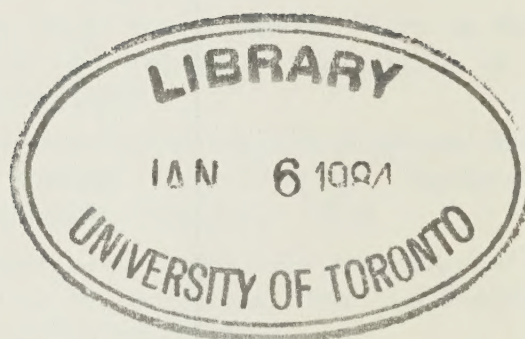
**EMPLOYMENT OUTLOOK FOR PROFESSIONAL PERSONNEL**  
**in Scientific and Technical Fields**  
**1960 – 1962**

**Professional Manpower Bulletin No. 8**

**ECONOMICS AND RESEARCH BRANCH**  
**DEPARTMENT OF LABOUR**  
**Ottawa, October 1960**

**Hon. Michael Starr**  
**Minister**





ROGER DUHAMEL, F.R.S.C.  
QUEEN'S PRINTER AND CONTROLLER OF STATIONERY  
OTTAWA, 1961

Price .25 cents Cat. No. L2-2008

Available from the Queen's Printer

Ottawa, Canada



## FOREWORD

*This is the eight in a series of bulletins dealing with various aspects of scientific and technical manpower in Canada, prepared by the Economics and Research Branch of the Department of Labour. This bulletin deals with the employment outlook for 1960, 1961, and 1962 for scientists, engineers, and architects, including problems of recruitment and sources of scientific and technical personnel based on a survey made in 1960. A previous bulletin in this same series, Bulletin No. 5, dealt with the same subject for the years 1958-1960.*

*A preliminary release of some of the major findings coming out of this survey was published in July 1960. <sup>(1)</sup>*

*In the preparation of this bulletin the Economics and Research Branch wishes to acknowledge with thanks the assistance of the General Assignments Division of the Dominion Bureau of Statistics in the selection of the sample, and the Executive and Professional Section of the Unemployment Insurance Commission, for help in securing a high degree of response from the organizations concerned. A vote of thanks is also due the Canadian employers who co-operated in this survey.*

*The information contained in this bulletin was prepared and written by Mr. A.M. Sargent under the supervision of Mr. P.H. Casselman and the general direction of Mr. J.P. Francis.*

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(1) 1960 Biennial Survey of Requirements for Professional Personnel in Scientific and Technical Fields, Preliminary Release of Tabulations, Economics and Research Branch, Department of Labour, July 1960, 9 pp.







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## Introduction

In the spring and summer of 1960 the Economics and Research Branch of the Department of Labour conducted a survey of employers in industry, colleges and universities, and government agencies to obtain information regarding the recent and probable future trends in the employment of engineers, scientists, and architects in Canada, and some of the factors affecting these trends. The survey was the seventh of a series conducted by the Branch since 1946. The co-operating employers provided data on total employment, and on recent and anticipated employment for 16 categories of professional personnel, in addition to information regarding recruitment difficulties, shortages of professional personnel, and numbers of professionals hired or up-graded from sub-professional ranks. In this survey employers were asked to include the following personnel in their reports:

- (1) those with university degrees;
- (2) members of recognized professional associations;
- (3) others who in their judgment were doing scientific or technical work at the professional level.

The mailing list for this survey included all industrial establishments or organizations employing more than 100 workers in the following employment fields: mining and quarrying, manufacturing, transportation and public utilities, trade and finance, colleges and universities, and government agencies. For the construction industry the coverage was restricted to firms employing more than 200 workers. This was a change from the preceding surveys and was made because of the industry's extreme fluctuations in employment levels and its relatively low concentration of engineering and scientific personnel. The coverage of firms in the business service (consultants) category included establishments of less than 100 workers because of their very high proportion of technical personnel. This was also a change from the previous survey and resulted in a larger and more representative coverage in this industry sector. The list did not include establishments in some specific industries which do not employ these types of professionals in significant numbers. These exceptions were the clothing, printing and publishing industries. The mailing list in the industrial sector was similar to that used by the Dominion Bureau of Statistics for its survey of "Industrial Research and Development Expenditures in Canada".

In the tabulation of the material, business service (consultants) was included in the industry sector, as were crown corporations. The government sector included federal departments and agencies other than crown corporations, provincial government departments and major municipal governments. Colleges and universities included all the major degree-granting educational institutions with the exception of veterinary colleges.

The survey covered almost 2,800 employers in industry, government and education, including a large number of multiple-establishment units, of which more than 2,600 or about 94 per cent submitted returns. Of the employers replying, 1,611 indicated that they employed engineers, scientists



or architects. These returns covered the employment of about 27,200 engineers, 12,500 scientists, and slightly over 600 architects.

*Table 1 — 1960 Survey Coverage — Number of Employers on Mailing List, with Percentage of Response, and Percentage Employing Engineers, Scientists and Architects*

Employment Sector	Number of Employers on Mailing List	Number of Employers Responding	Percentage Response	Number of Employers Responding who Employ Engineers, Scientists and Architects	Those who Employ Engineers, Scientists and Architects as a Percentage of those Responding
Industry .....	2, 649	2, 487	93. 9	1, 489	59. 9
Colleges and universities.	32	30	93. 8	30	100. 0
Government agencies .....	104	94	90. 4	92	97. 9
Total coverage.	2, 785	2, 613	93. 8	1, 611	61. 7

The professions covered in this survey included eight engineering groups:

Aeronautical  
Chemical  
Civil  
Electrical

Geological  
Mechanical  
Metallurgical  
Mining

and seven scientific groups:

Biologists  
Chemists  
Geologists  
Mathematicians

Physicists  
Forestry Scientists (and Engineers)  
Agricultural Scientists (and Engineers)

as well as Architects.

The returns included information on several other engineering and scientific fields, but these data have not been tabulated because of the relatively small number of personnel concerned. No attempt was made to include in the survey such classes of professional personnel as lawyers, medical doctors, dentists, and veterinarians, most of whom tend to practice as self-employed persons.

The industrial sector of the economy employed most of the engineers who were reported in the survey, namely, 82.7 per cent as compared with 14.1 per cent in government agencies, and 3.2 per cent in colleges and universities (Table 2). Within the industry sector a significant group was that of professional service which employed 8.7 per cent of the engineers. In considering the different engineering fields, industry employed over 80 per cent in each with the exception of civil engineers where it employed



Table 2 — Numbers of Engineers, Scientists and Architects and Their Percentage Distribution, by Professional Field, Amongst Major Employment Sectors at December 31, 1959

Professional Field	All Employment Sectors		Total Industry	Mining and Quarrying	Manufacturing	Construction	Transportation and Public Utilities	Trade and Finance	Professional Service	Colleges and Universities	Government Agencies
	Number	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent
All Engineers .....	27,238	100.0	82.7	5.9	48.4	3.1	16.7	-	8.7	3.2	14.1
Aeronautical .....	458	100.0	77.9	-	73.6	-	3.9	-	*	9.2	12.9
Chemical .....	3,400	100.0	91.8	6.8	78.5	*	2.4	-	3.9	3.3	4.9
Civil .....	6,980	100.0	60.3	1.2	14.5	10.2	17.0	-	17.4	3.2	36.5
Electrical .....	7,218	100.0	90.1	1.5	47.6	0.8	35.8	-	4.4	2.1	7.8
Geological .....	504	100.0	82.9	50.8	21.4	*	6.9	-	3.6	10.5	6.5
Mechanical .....	6,509	100.0	92.3	1.8	71.8	0.8	8.8	-	9.2	2.6	5.1
Metallurgical .....	936	100.0	86.4	19.7	58.5	*	2.2	-	5.9	7.2	6.3
Mining .....	1,233	100.0	88.6	50.3	31.1	1.5	3.6	-	1.9	5.0	6.4
All Scientists .....	12,584	100.0	41.1	5.1	30.0	-	1.7	1.4	2.9	13.7	45.2
Biologists .....	921	100.0	13.5	-	10.7	-	3.3	-	2.4	42.7	43.3
Chemists .....	3,471	100.0	73.3	2.7	65.9	-	0.9	-	3.9	7.4	19.3
Geologists .....	866	100.0	67.3	46.5	18.7	-	1.2	-	0.9	10.6	22.1
Mathematicians .....	732	100.0	48.4	2.6	10.9	-	8.2	24.3	2.3	40.8	10.8
Physicists .....	1,762	100.0	33.4	5.3	16.7	-	3.0	-	8.3	16.6	50.0
Forestry scientists .....	1,049	100.0	52.7	0.6	49.4	*	0.7	-	1.9	4.8	42.5
Agricultural scientists .....	3,783	100.0	11.3	0.7	8.9	-	1.4	-	*	8.9	79.8
Architecture .....	614	100.0	55.2	*	5.4	1.1	9.8	*	38.4	8.6	36.2

\* Totals too small for computation of percentages.



slightly more than 60 per cent. In the case of civil engineers, a considerably higher proportion were employed by government agencies, 36.5 per cent, than was the case for the other engineering fields.

The government was the largest employer of scientists covered in the survey, 45.2 per cent as compared with 41.1 per cent in industry, and 13.7 at colleges and university, (Table 2). The results of the survey reveal that there was great differences in the type of employer from one science field to the other. Industry, for example, employed as few as 13.5 per cent of the biologists but as high as 73.3 per cent of the chemists covered in the survey. On the other hand, government agencies employed only 10.8 per cent of the mathematicians but almost 80 per cent of the agricultural scientists.

In this report, the data on requirements represents anticipated changes in the number of professional workers to be employed over the period specified. They do not refer to total hirings, which would also reflect needs arising from retirements and transfers or resignations. In Table 3, for example, the reported increases of 7.3 per cent for the requirements for engineers as a whole and 5.8 per cent for scientists during 1960 indicate that employers expected to employ 7.3 per cent more engineers and 5.8 per cent more scientists at the end of 1960 than they had employed at the end of 1959. Similarly, the increase of 5.0 per cent for engineers as a whole and 4.9 per cent for scientists during 1961 indicated that employers anticipated that they will employ 5 per cent more engineers and 4.9 per cent more scientists at the end of 1961 than they expect to have in their employ at the end of 1960. The yearly percentage increases in 1960, 1961, and 1962 are then averaged to facilitate comparison of requirements for the different categories covered by the survey. These averages, referred to in the body of the report as average annual rates of increase, represent in each case an arithmetic mean of the three year-to-year increases in the requirements anticipated for 1960, 1961, and 1962.

In addition to tabulations based on the current survey, tables have been prepared on the basis of questionnaires received from employers who reported in both the 1958 and 1960 Biennial Survey of Requirements for Professional Personnel in Scientific and Technical Fields. These tables permitted a direct comparison to be made between the results of these two surveys.

The projections contained in this report are subject to errors characteristic of such forecasts because of the difficulty employers face in estimating requirements for specialized types of workers several years in advance, and under certain economic conditions.



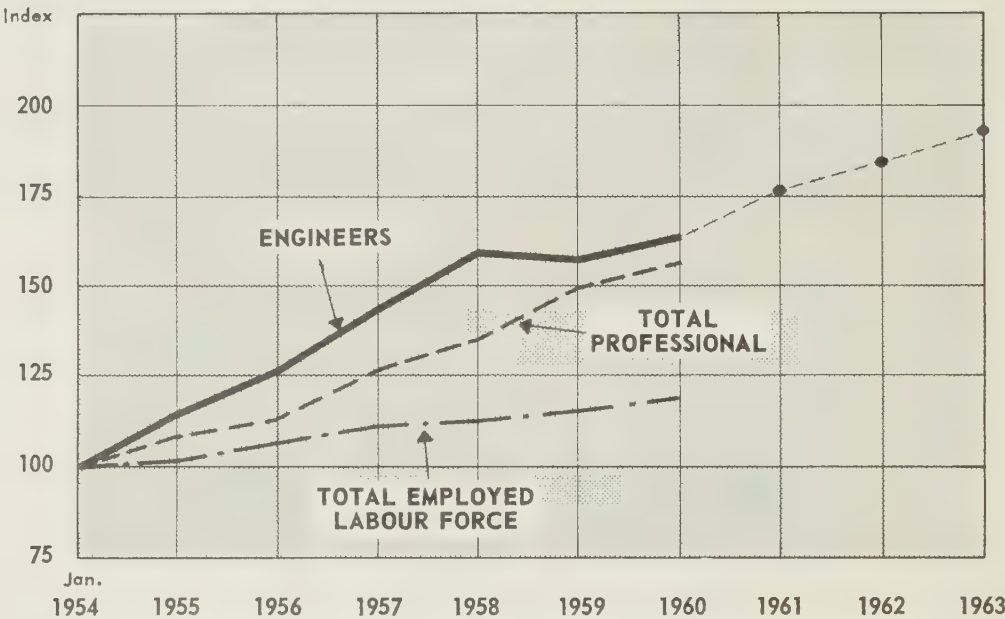
# MAJOR FINDINGS

## A Graphic Outline

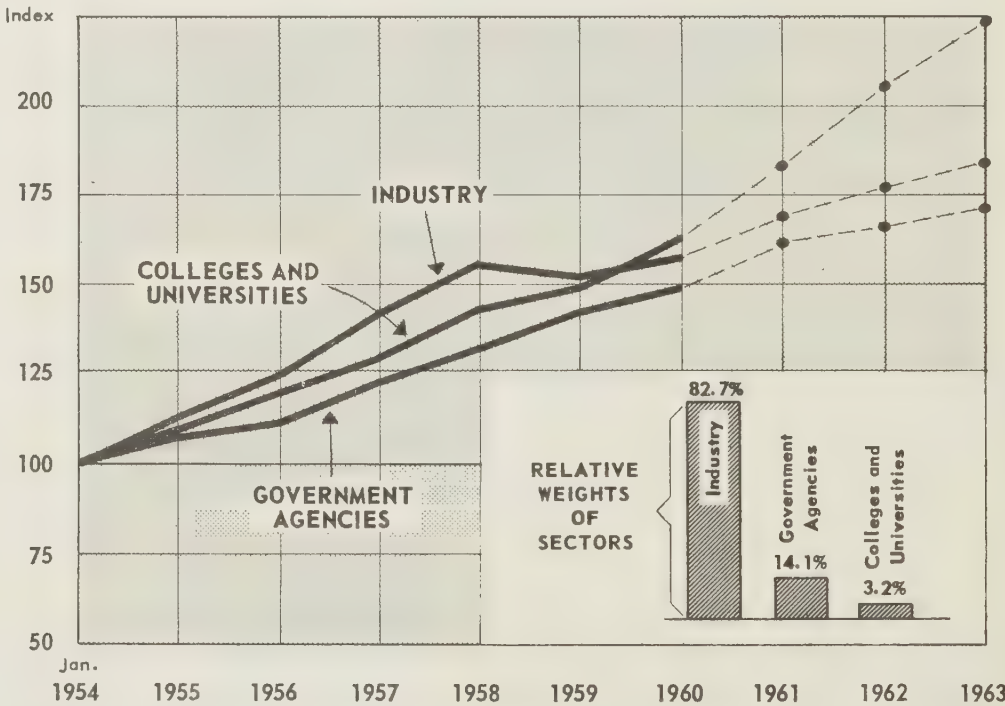


# GROWTH OF ENGINEERING EMPLOYMENT 1954 - 1960 AND FORECAST 1961 - 1963

COMPARED TO TOTAL EMPLOYED LABOUR FORCE  
AND TOTAL PROFESSIONAL EMPLOYMENT



# GROWTH OF ENGINEERING EMPLOYMENT IN THREE MAJOR EMPLOYMENT SECTORS 1954 - 1960 AND FORECAST 1961 - 1963





# TRENDS IN ENGINEERING EMPLOYMENT

## *Employment Trends of Engineers, Total Professional Workers and Employed Labour Force*

(January 1 — 1954 = 100.0)

	Engineers	Total Employed Professional Workers <sup>(1)</sup>	Total Non-Farm Employment <sup>(1)</sup>
1954 .....	100.0	100.0	100.0
1955 .....	113.0	108.3	100.2
1956 .....	125.3	112.5	107.2
1957 .....	143.3	125.9	112.0
1958 .....	159.4	134.7	112.2
1959 .....	156.9	149.3	115.0
1960 .....	163.8	155.7	119.0
1961 (forecast) .....	175.8	—	—
1962 (forecast) .....	184.5	—	—
1963 (forecast) .....	192.1	—	—

## *Employment Trends of Engineers by Major Employment Sectors*

(January 1 — 1954 = 100.0)

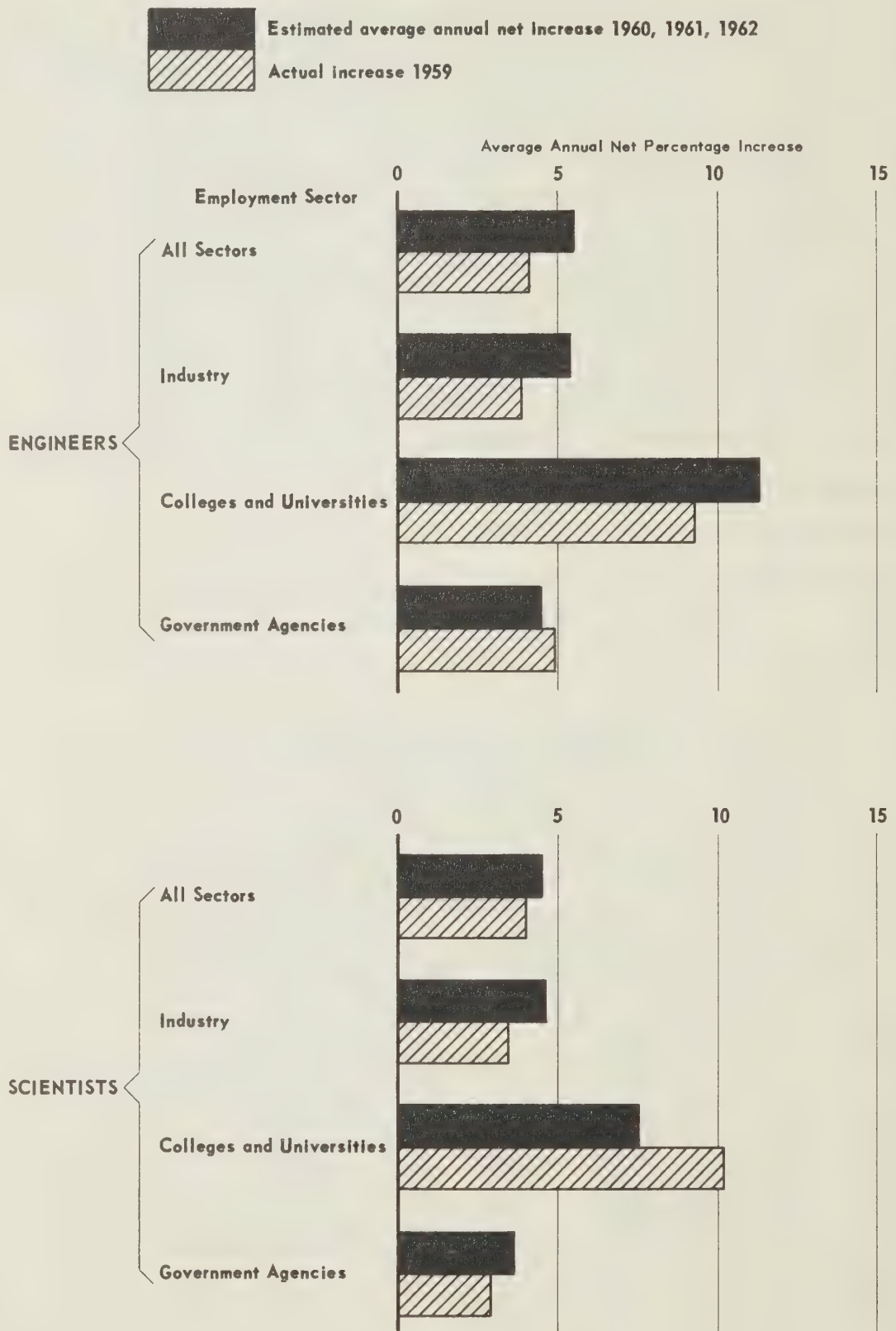
	Industry	Colleges and Universities	Government Agencies
1954 .....	100.0	100.0	100.0
1955 .....	112.3	109.8	105.8
1956 .....	124.4	119.4	111.1
1957 .....	140.7	128.7	121.9
1958 .....	155.5	143.0	131.2
1959 .....	151.2	148.7	142.1
1960 .....	157.1	162.6	149.5
1961 (forecast) .....	168.1	184.8	160.8
1962 (forecast) .....	176.6	205.4	165.6
1963 (forecast) .....	183.9	224.3	170.3

1) Source: Special Surveys Division, Dominion Bureau of Statistics.



# INCREASES IN THE EMPLOYMENT OF ENGINEERS AND SCIENTISTS EXPECTED DURING 1960 - 1962

ACTUAL INCREASES DURING 1959





# REQUIREMENTS FOR ENGINEERS AND SCIENTISTS

During the three-year period 1960 to 1962 the employment of engineers is expected to increase at an average rate of 5.5 per cent a year.

The actual increase during 1959 was 4.2 per cent.

The employment of scientists is expected to increase over the three-year period at the average rate of 4.6 per cent a year.

The actual increase during 1959 was 4.1 per cent.

Increases during 1959 were greatest in the colleges and universities sector, 9.3 per cent for engineers and 10.2 per cent for scientists. A further increase to an average rate of 11.3 per cent a year is expected for engineers, but some reduction to 7.5 per cent is estimated for scientists each year during the three-year period.

In the industrial sector increases are expected in the employment of both engineers and scientists: from an actual gain of 3.9 per cent in 1959 to an average annual rate of 5.4 per cent for engineers, and from 3.5 to 4.7 per cent in the case of scientific manpower.

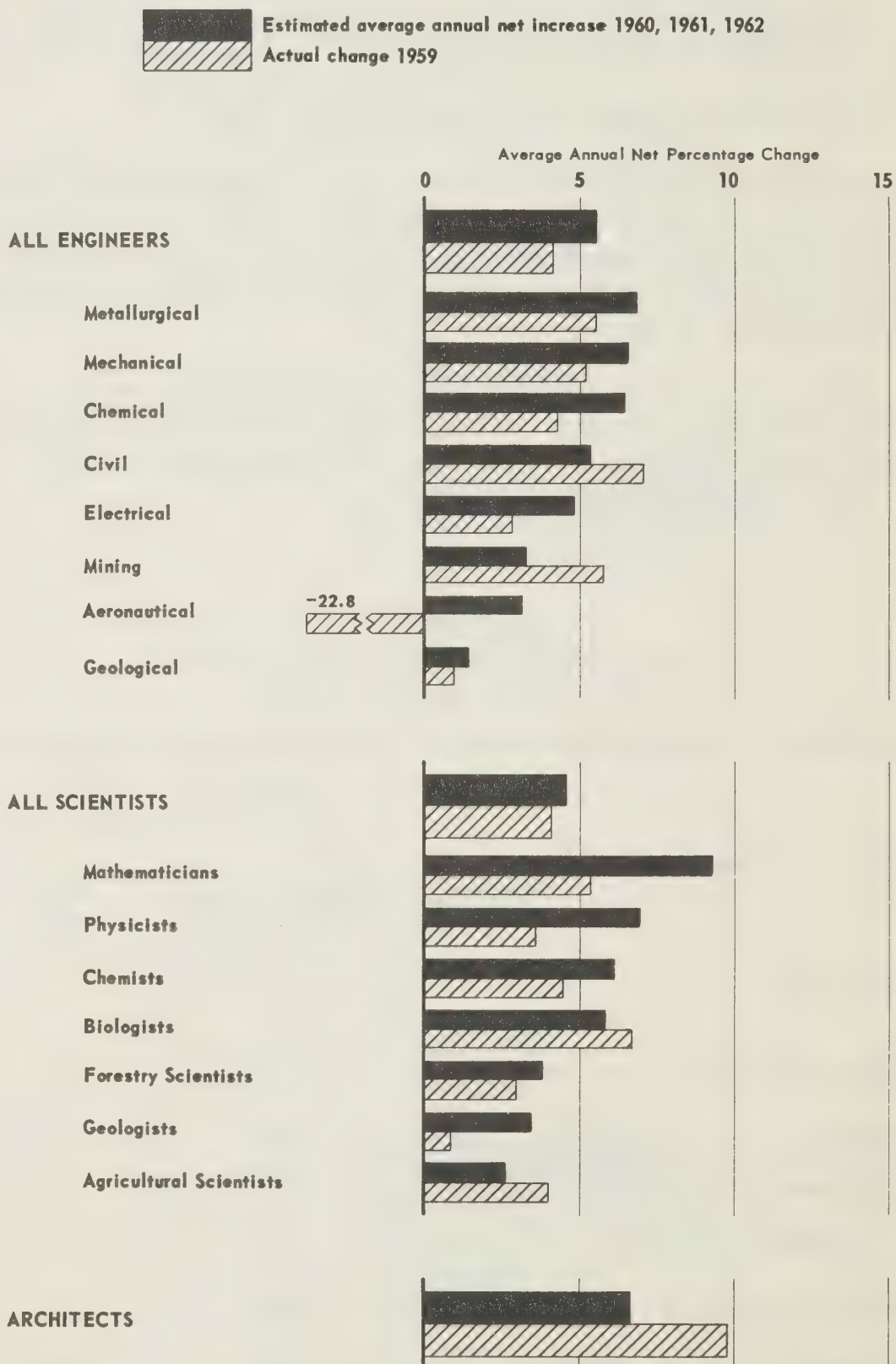
*Requirements for Engineers and Scientists  
by Major Employment Sectors*

Employment Sector	Percentage Net Change	
	Forecast Annual Average 1960-62	Actual 1959
Engineers, All Sectors .....	5.5	4.2
Industry .....	5.4	3.9
Colleges and universities .....	11.3	9.3
Government agencies .....	4.5	4.9
Scientists, All Sectors .....	4.6	4.1
Industry .....	4.7	3.5
Colleges and universities .....	7.5	10.2
Government agencies .....	3.7	2.9



# COMPARISON OF EMPLOYMENT INCREASES BETWEEN THE ENGINEERING AND SCIENTIFIC PROFESSIONS EXPECTED DURING 1960-1962

## ACTUAL CHANGES DURING 1959





COMPARISON OF REQUIREMENTS BETWEEN PROFESSIONAL FIELDS

In the engineering professions the greatest increases in employment are expected in the metallurgical, mechanical and chemical fields, and in each of these the average annual rate of increase expected during the three-year period is greater than the actual increase of 1959.

The fields in which the least gains are expected are geological, aeronautical and mining.

In the scientific professions, requirements are highest for mathematicians, physicists and chemists ranging from 9.3 per cent in the case of the first to 6.1 in the case of chemists.

All science fields except biologists and agricultural scientists show an increase in forecast percentage changes for 1960-62 as compared with the actual changes reported in 1959.

Smallest increases in requirements are anticipated for agricultural scientists, geologists and forestry scientists.

Requirements for Engineers, Scientists, and Architects by Their Professional Field

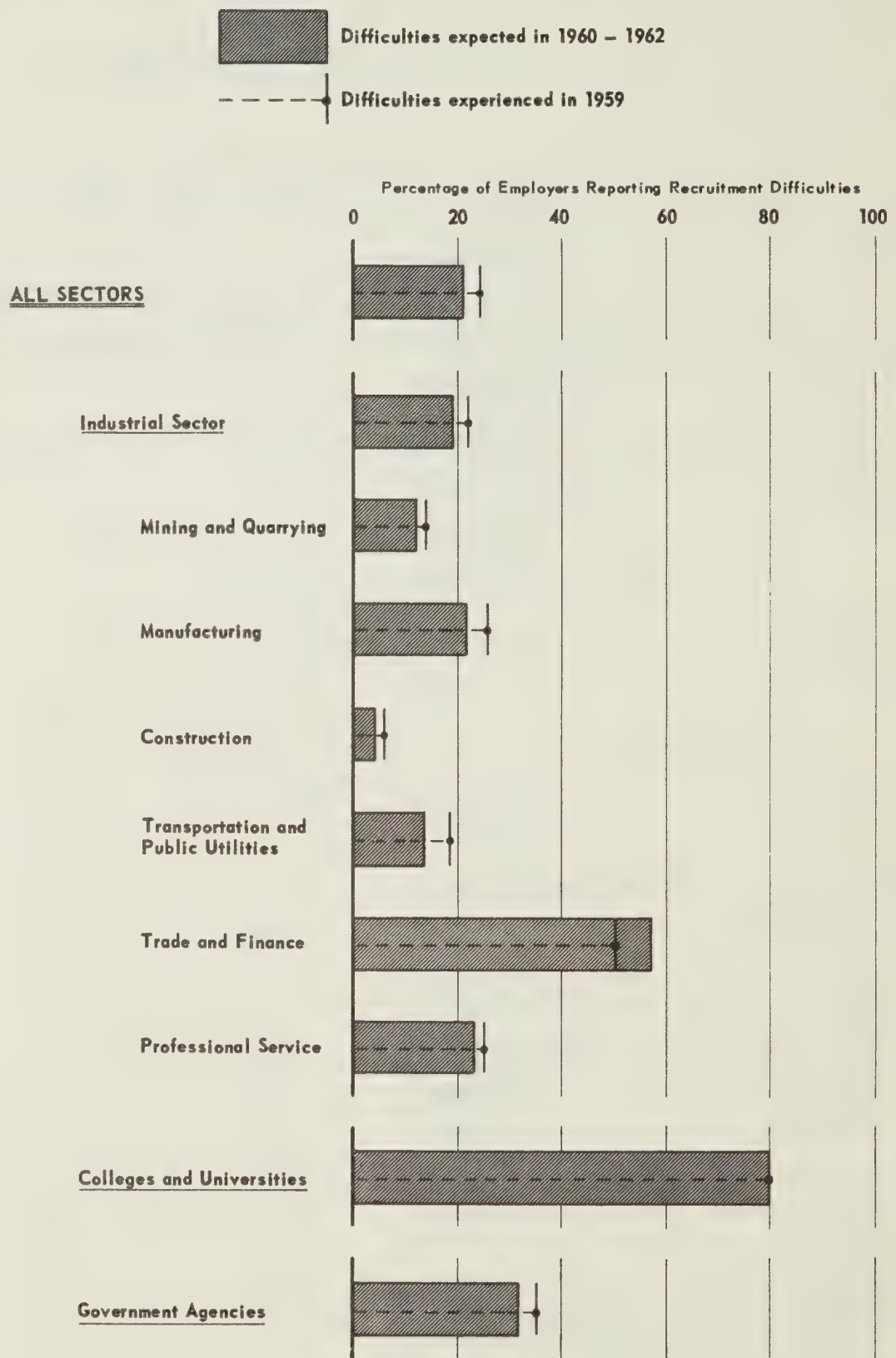
Professional Field	Percentage Net Change	
	Forecast Annual Average 1960-62	Actual 1959
All Engineers .....	5.5	4.2
Metallurgical .....	6.8	5.5
Mechanical .....	6.5	5.2
Chemical .....	6.4	4.3
Civil .....	5.3	7.0
Electrical .....	4.8	2.8
Mining .....	3.3	5.7
Aeronautical .....	3.2	-22.8
Geological .....	1.4	1.0
All Scientists .....	4.6	4.1
Mathematicians .....	9.3	5.3
Physicists .....	6.9	3.6
Chemists .....	6.1	4.5
Biologists .....	5.8	6.7
Forestry scientists .....	3.8	3.0
Geologists.....	3.5	0.9
Agricultural scientists .....	2.6	4.0
Architects .....	6.6	9.8

N.B. All quantities are plus quantities except where minus signs are indicated.



# RECRUITMENT DIFFICULTIES EXPECTED IN THE DIFFERENT EMPLOYMENT SECTORS DURING 1960 - 1962

## EXTENT OF RECRUITMENT DIFFICULTIES DURING 1959





## RECRUITING DIFFICULTIES BY EMPLOYMENT SECTORS

Twenty-one per cent of the establishments employing professionals anticipate difficulty in recruiting the additional professional personnel which they will require during the next three years. This is a decrease from the 24 per cent of the establishments which experienced difficulties in 1959.

In the industrial sector 18.9 per cent of reporting firms anticipate recruiting troubles. This is down from the actual of 22.1 per cent for 1959.

The proportion of colleges and universities expecting difficulties remains high at 80 per cent.

There is a decrease in the proportion of government agencies anticipating hiring difficulties from that which experienced trouble during 1959: down from 34.8 to 31.5 per cent.

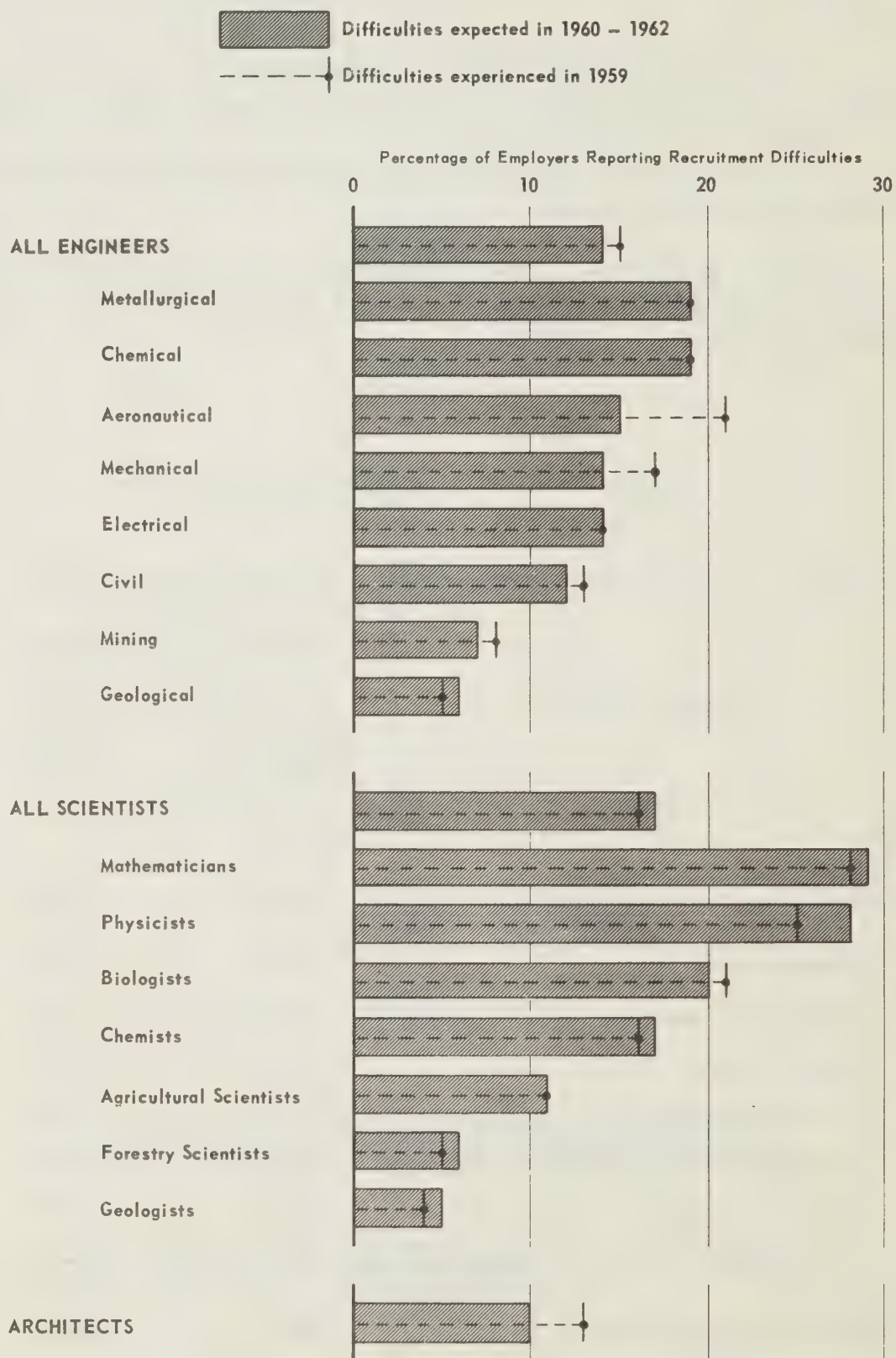
### *Difficulties in Recruiting Professional Personnel by Employment Sectors*

Employment Sector	Percentage of Establishments Reporting Recruiting Difficulties	
	Anticipated 1960-62	Actual 1959
All Employment Sectors .....	21.0	24.0
Industrial sector.....	18.9	22.1
Mining and quarrying .....	11.9	13.5
Manufacturing .....	21.5	25.4
Construction .....	4.3	6.0
Transportation and public utilities ..	13.6	18.6
Trade and finance .....	57.1	50.0
Professional service .....	23.3	24.8
Colleges and universities .....	80.0	80.0
Government agencies .....	31.5	34.8



# COMPARISON OF RECRUITMENT DIFFICULTIES BETWEEN ENGINEERING AND SCIENTIFIC PROFESSIONS EXPECTED DURING 1960 - 1962

## EXTENT OF RECRUITMENT DIFFICULTIES DURING 1959





# RECRUITING DIFFICULTIES BY PROFESSIONAL FIELD

Little change in the incidence of recruiting difficulties is expected among the different professional fields between their expectations for 1960 to 1962 and their experience of 1959.

Fourteen per cent of establishments employing engineers expect recruiting difficulties during the three-year period. This is down one per cent from the proportion which experienced difficulties during 1959.

For scientists, 17 per cent anticipate difficulties in hiring, 16 per cent report having had trouble last year.

Remaining highest on the difficulty list in the engineering fields are metallurgical and chemical.

Highest in the scientific fields are mathematicians, physicists and biologists.

*Difficulties in Recruiting Professional Personnel  
by Their Professional Fields*

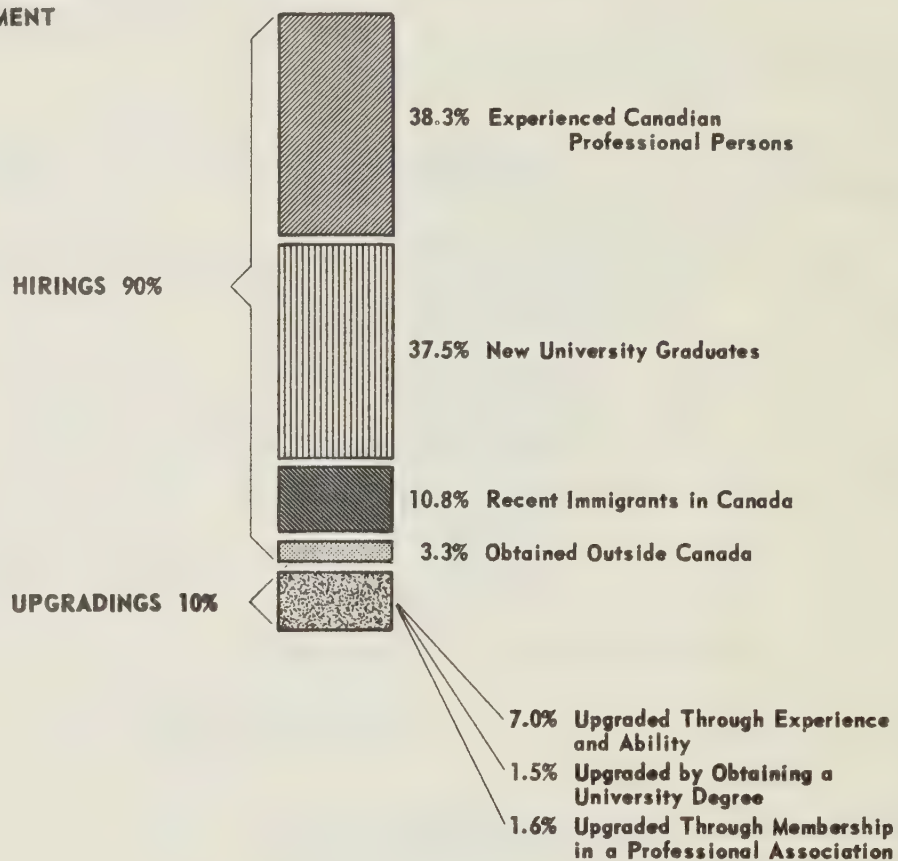
Professional Field	Percentage of Establishments Reporting Recruiting Difficulties	
	Anticipated 1960-62	Actual 1959
All Establishments Employing Engineers ..	13.8	14.9
Metallurgical .....	19.0	19.0
Chemical .....	18.6	18.6
Aeronautical .....	15.4	20.5
Mechanical .....	14.5	16.9
Electrical .....	13.6	14.0
Civil .....	11.7	12.9
Mining .....	7.4	7.8
Geological .....	6.3	5.3
All Establishments Employing Scientists ..	16.8	16.0
Mathematicians .....	29.0	28.0
Physicists .....	28.5	25.4
Biologists .....	20.0	21.3
Chemists .....	16.7	16.2
Agricultural scientists .....	11.4	11.4
Forestry scientists .....	6.3	5.4
Geologists .....	5.3	4.5
All Establishments Employing Architects ..	10.1	12.6



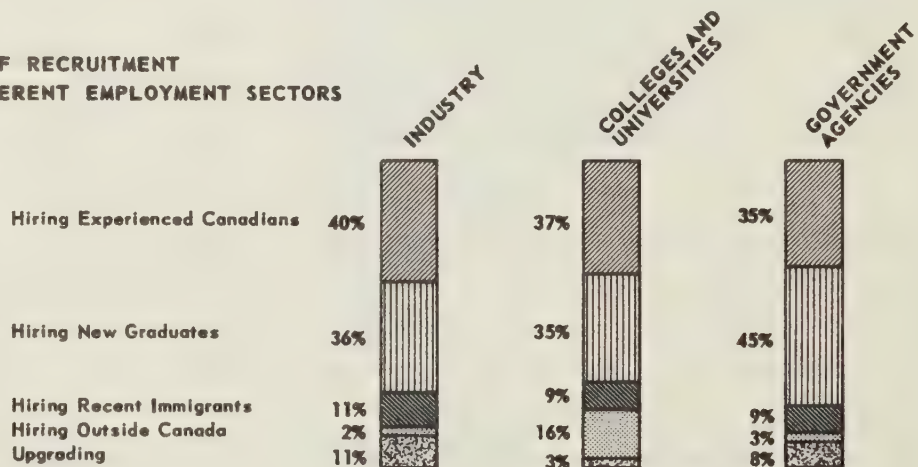
# SOURCES OF PROFESSIONAL RECRUITMENT IN 1959

## COMPARISON OF SOURCES BETWEEN MAJOR EMPLOYMENT SECTORS

### TOTAL PROFESSIONAL RECRUITMENT



### SOURCES OF RECRUITMENT IN DIFFERENT EMPLOYMENT SECTORS





## Tabular Presentation of Findings

This section presents in tabular form the detail findings of the survey. The first three tables, in the section, **Tables 3 to 5**, are concerned with the major aspect of the survey, that of the forecasts of requirements for engineers, scientists and architects. **Table 3** presents the forecasts for the total of all engineers and the total of all scientists in each of the employment sectors. **Table 4** shows the forecasts for each of the engineering and scientific fields separately, and **Table 5** presents, with the same breakdown as Table 3, employment changes, actual and forecast, from 1957 to 1962. This latter table is based on the 1958 as well as the 1960 survey.

**Tables 6 and 7** present the material on the difficulties which employers experienced and are expecting to experience in the hiring of professional personnel. **Table 6** shows this according to employment sectors, and **Table 7** by each of the individual engineering and scientific fields.

**Table 8** deals with the sources of hirings of engineers, scientists and architects. **Table 9** presents information on the upgrading of employees to professional status.

Following Table 9 the requirements of engineers, scientists and architects are presented in individual tables, one for each of the professional fields. There are eight tables for the engineering fields, seven for the scientific fields and one for architects. These tables present the forecast requirements according to the three major employment sectors, industry, colleges and universities, and government agencies.



Table 3 — Actual Rates of Change in Employment of Engineers and Scientists between 1958 and 1959,  
Forecast Rates of Change during 1960, 1961 and 1962 by Employment Sector

Employment Sector	Actual Employment		Forecast Employment				
	Employment at Dec. 31, 1958	Employment at Dec. 31, 1959	Percentage Change During 1959	Percentage Change During 1960	Percentage Change During 1961	Percentage Change During 1962	Average of Percentage Changes 1960-62
Engineers — all sectors .....							
Total industry .....	26,137	27,238	4.2	7.3	5.0	4.1	5.5
Mining and quarrying .....	21,679	22,525	3.9	7.0	5.1	4.1	5.4
Manufacturing .....	1,556	1,605	3.1	3.2	2.2	2.4	2.6
Construction .....	13,047	13,170	0.9	8.0	5.2	4.4	5.9
Transportation and public utilities ..	745	844	13.3	4.9	7.1	3.8	5.3
Trade and finance .....	4,326	4,542	5.0	5.3	4.0	3.4	4.2
Professional service .....	—	—	—	—	—	—	—
Colleges and universities .....	2,005	2,364	17.9	8.1	7.7	5.2	7.0
Government agencies .....	803	878	9.3	13.7	11.0	9.2	11.3
Scientists — all sectors .....							
Total industry .....	3,655	3,835	4.9	7.6	3.0	2.8	4.5
Mining and quarrying .....	12,089	12,584	4.1	5.8	4.9	3.2	4.6
Manufacturing .....	4,996	5,173	3.5	5.6	5.5	3.1	4.7
Construction .....	617	639	3.6	1.1	3.1	2.0	2.1
Transportation and public utilities ..	3,638	3,775	3.8	6.7	6.0	3.0	5.2
Trade and finance .....	4	3	*	—	—	—	—
Professional service .....	204	217	6.4	8.8	4.2	6.1	6.4
Colleges and universities .....	171	179	4.7	8.9	9.7	6.1	8.2
Government agencies .....	362	360	— 0.7	— 2.0	2.5	1.9	0.8
Engineers — all sectors .....							
Total industry .....	1,562	1,722	10.2	8.6	7.6	6.2	7.5
Mining and quarrying .....	5,531	5,689	2.9	5.1	3.5	2.4	3.7

\*Totals too small for computation of percentages.

N.B. All quantities are plus quantities except where minus signs are indicated.



Table 4 — Actual Rates of Change in Employment of Engineers Scientists and Architects between 1958 and 1959, Forecast Rates of Change during 1960, 1961 and 1962 by Professional Field

Professional Field	Actual Employment			Forecast Employment			
	Employment at Dec. 31, 1958	Employment at Dec. 31, 1959	Percentage Change During 1959	Percentage Change During 1960	Percentage Change During 1961	Percentage Change During 1962	Average of Percentage Changes 1960-62
All Engineers .....	26,137	27,238	4.2	7.3	5.0	4.1	5.5
Aeronautical.....	593	458	-22.8	2.0	4.1	3.5	3.2
Chemical .....	3,260	3,400	4.3	8.7	5.7	4.7	6.4
Civil.....	6,522	6,980	7.0	6.5	5.1	4.3	5.3
Electrical.....	7,023	7,218	2.8	6.7	4.3	3.4	4.8
Geological.....	499	504	1.0	*	2.4	1.9	1.4
Mechanical.....	6,186	6,509	5.2	8.7	6.1	4.8	6.5
Metallurgical.....	887	936	5.5	11.4	4.5	4.6	6.8
Mining.....	1,167	1,233	5.7	5.6	1.9	2.5	3.3
All Scientists .....	12,089	12,584	4.1	5.8	4.9	3.2	4.6
Biologists.....	861	921	6.7	6.8	5.4	5.1	5.8
Chemists .....	3,320	3,471	4.5	5.4	6.3	2.5	6.1
Geologists.....	858	866	0.9	5.9	2.7	2.0	3.5
Mathematicians .....	695	732	5.3	9.6	11.0	7.2	9.3
Physicists .....	1,701	1,762	3.6	8.8	6.8	5.2	6.9
Forestry scientists.....	1,018	1,049	3.0	5.6	3.8	1.9	3.8
Agricultural scientists .....	3,636	3,783	4.0	3.7	2.1	2.1	2.6
Architects .....	559	614	9.8	12.2	5.5	2.1	6.6

\* Totals too small for computation of percentages.  
N.B. All quantities are plus quantities except when minus signs are indicated.



Table 5 — Actual and Forecast Annual Rates of Change in Employment of Engineers and Scientists by Employment Sector, 1957 to 1962  
(Based on 1958 and 1960 Surveys)<sup>(1)</sup>

Employment Sector	Percentage Change in Employment										
	1958 Survey					1960 Survey				1958 Survey	1960 Survey
	Actual Change During 1957	Forecast Change During 1958	Forecast Change During 1959	Forecast Change During 1960	Actual Change During 1959	Forecast Change During 1960	Forecast Change During 1961	Forecast Change During 1962	Average Forecast Change 1958-1960	Average Forecast Change 1960-1962	
Engineers — all sectors .....	10.1	6.9	4.8	4.9	4.2	7.3	5.0	4.1	5.5	5.5	
Total industry .....	10.5	5.5	4.8	5.0	3.9	7.0	5.1	4.1	5.1	5.4	
Mining and quarrying .....	9.3	3.8	3.0	2.9	3.1	3.2	2.2	2.4	3.2	2.6	
Manufacturing .....	11.8	4.7	5.9	5.8	0.9	8.0	5.2	4.4	5.5	5.9	
Construction(3) .....	10.9	4.0	12.2	10.9	13.3	4.9	7.1	3.8	9.0	5.3	
Transportation and public utilities .....	11.3	6.7	3.1	2.6	5.0	5.3	4.0	3.4	4.1	4.2	
Trade and finance .....	*	*	*	—	—	—	—	—	*	—	
Professional service(2) .....	— 4.8	14.1	— 5.5	2.4	17.9	8.1	7.7	5.2	3.6	7.0	
Colleges and universities .....	11.1	10.5	11.1	9.2	9.3	13.7	11.0	9.2	10.3	11.3	
Government agencies .....	7.1	15.2	3.6	3.0	4.9	7.6	3.0	2.8	7.2	4.5	
Scientists — all sectors .....	10.2	4.5	5.3	5.7	4.1	5.8	4.9	3.2	5.2	4.6	
Total industry .....	12.4	5.6	5.0	5.4	3.5	5.6	5.5	3.1	5.3	4.7	
Mining and quarrying .....	15.1	4.7	2.8	4.1	3.6	1.1	3.1	2.0	3.9	2.1	
Manufacturing .....	11.4	5.4	5.4	5.8	3.8	6.7	6.0	3.0	5.5	5.2	
Construction(3) .....	*	*	*	*	*	—	—	—	*	*	
Transportation and public utilities .....	9.2	14.3	5.7	4.3	6.4	8.8	4.2	6.1	8.1	6.4	
Trade and finance .....	6.7	6.3	8.5	5.4	4.7	8.9	9.7	6.1	6.7	8.2	
Professional service(2) .....	30.2	3.0	0.6	2.9	— 0.7	— 2.0	2.5	1.9	2.2	0.8	
Colleges and universities .....	10.2	7.2	7.3	6.8	10.2	8.6	7.6	6.2	7.1	7.5	
Government agencies .....	5.5	4.8	4.9	5.5	2.9	5.1	3.5	2.4	5.1	3.7	

(1) The 1958 Survey covered 34,623 Engineers and Scientists, and 1,349 Employers, at December 31, 1957; the 1960 Survey covered 39,822 Engineers and Scientists, and 1,489 Employers, at December 31, 1959.

(2) The coverage for Professional Service was much larger in the 1960 Survey than in 1958.

(3) The coverage for Construction was considerably smaller in the 1960 Survey than in 1958.

\* Totals too small for computation of percentages.

N.B. All quantities are plus quantities except where minus signs are indicated.



Table 6 — Employers Reporting Difficulties in Recruiting Engineers, Scientists and Architects by  
Employment Sector During 1959; and Anticipating Difficulties During 1960–1962

Employment Sector	Number of Employers of Engineers, Scientists and Architects	Employers Recruiting Reporting Difficulties During 1959		Employers Anticipating Recruiting Difficulties During 1960–1962	
		Number	Per Cent	Number	Per Cent
All Sectors .....	1,489	358	24.0	312	21.0
Total industry .....	1,367	302	22.1	259	18.9
Mining and quarrying .....	126	17	13.5	15	11.9
Manufacturing .....	764	194	25.4	164	21.5
Construction .....	117	7	6.0	5	4.3
Transportation and public utilities .....	140	26	18.6	19	13.6
Trade and finance .....	14	7	50.0	8	57.1
Professional service .....	206	51	24.8	48	23.3
Colleges and universities .....	30	24	80.0	24	80.0
Government agencies .....	92	32	34.8	29	31.5



Table 7 — Employers Reporting Difficulties in Recruiting Engineers, Scientists and Architects by Professional Field During 1959 and Anticipating Difficulties During 1960-1962

Professional Field	Total Number of Employers of this Profession	Employers Reporting Recruiting Difficulties During 1959		Employers Anticipating Recruiting Difficulties During 1960-1962	
		Number	Per Cent	Number	Per Cent
All Engineers.....	2,938	437	14.9	405	13.8
Aeronautical.....	39	8	20.5	6	15.4
Chemical.....	370	69	18.6	69	18.6
Civil.....	634	82	12.9	74	11.7
Electrical.....	543	76	14.0	74	13.6
Geological.....	95	5	5.3	6	6.3
Mechanical.....	830	140	16.9	120	14.5
Metallurgical.....	210	40	19.0	40	19.0
Mining.....	217	17	7.8	16	7.4
All Scientists.....	1,044	167	16.0	175	16.8
Biologists.....	75	16	21.3	15	20.0
Chemists.....	395	64	16.2	66	16.7
Geologists.....	112	5	4.5	6	5.4
Mathematicians.....	107	30	28.0	31	29.0
Physicists.....	130	33	25.4	37	28.5
Forestry Scientists.....	111	6	5.4	7	6.3
Agricultural Scientists.....	114	13	11.4	13	11.4
Architects.....	119	15	12.6	12	10.1



Table 8 — Sources of Hirings of Engineers, Scientists and Architects During 1959  
by Major Employment Sectors

Employment Sector	Total Hirings, 1959		New University Graduates		Experienced Canadian Professional Persons		Recent Immigrants to Canada		Obtained Outside Canada	
	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent
All Sectors.....	4,964	100.0	2,072	41.7	2,117	42.6	590	11.9	185	3.7
Total Industry.....	3,687	100.0	1,496	40.6	1,630	44.2	464	12.6	97	2.6
Mining and quarrying .....	250	100.0	105	42.0	125	50.0	15	6.0	5	2.0
Manufacturing .....	2,241	100.0	941	42.0	945	42.2	289	12.9	66	2.9
Construction .....	151	100.0	41	27.2	86	57.0	24	15.9	—	—
Transportation and public utilities.....	460	100.0	267	58.0	164	35.7	27	5.9	2	0.4
Trade and finance.....	15	100.0	11	73.3	3	20.0	—	—	1	6.7
Professional services.....	570	100.0	131	23.0	307	53.9	109	19.1	23	4.0
Colleges and universities.....	359	100.0	130	36.2	135	37.6	33	9.2	61	17.0
Government agencies .....	918	100.0	446	48.6	352	38.3	93	10.1	27	2.9



Table 9 — Upgradings of Employees to Professional Status During 1959  
by Major Employment Sectors

Employment Sector	Total Number Upgraded in 1959		Through Experience and Ability		By Obtaining a University Degree		By Membership in a Professional Association (Without a University Degree)	
	Number	Per Cent	Number	Per Cent	Number	Per Cent	Number	Per Cent
All Sectors.....	560	100.0	385	68.7	87	15.6	88	15.7
Total Industry .....	465	100.0	341	73.4	62	13.3	62	13.3
Mining and quarrying.....	37	100.0	36	97.3	—	—	1	2.7
Manufacturing .....	238	100.0	188	79.0	25	10.5	25	10.5
Construction.....	8	100.0	8	100.0	—	—	—	—
Transportation and public utilities.....	63	100.0	30	47.6	19	30.2	14	22.2
Trade and finance .....	—	—	—	—	—	—	—	—
Professional services .....	119	100.0	79	66.4	18	15.1	22	18.5
Colleges and universities .....	11	100.0	4	36.4	7	63.6	—	—
Government agencies.....	84	100.0	40	47.6	18	21.4	26	31.0



ENGINEERING FIELDS

Aeronautical Engineers

Annual Rates of Change in Employment of Aeronautical Engineers

Sector	Percentage Net Change				
	Actual Change 1959	Forecast			
		1960	1961	1962	Annual Average 1960-62
All Sectors .....	-22.8	2.0	4.1	3.5	3.2
Industry .....	-27.5	2.5	0.5	3.3	2.1
Colleges and universities .....	- 6.7	7.1	31.1	6.7	15.0
Government agencies .....	5.3	-5.1	5.3	1.7	0.6

Chemical Engineers

Annual Rates of Change in Employment of Chemical Engineers

Sector	Percentage Net Change				
	Actual Change 1959	Forecast			
		1960	1961	1962	Annual Average 1960-62
All Sectors .....	4.3	8.7	5.7	4.7	6.4
Industry .....	4.2	9.0	5.5	4.8	6.4
Colleges and universities .....	9.7	10.6	14.4	5.6	10.2
Government agencies .....	2.5	1.8	3.0	2.3	2.4

\*Totals too small for computation of percentages.  
N.B. All quantities are plus quantities except where minus signs are indicated.



## Civil Engineers

### *Annual Rates of Change in Employment of Civil Engineers*

Sector	Percentage Net Change				
	Actual Change 1959	Forecast			
		1960	1961	1962	Annual Average 1960-62
All Sectors .....	7.0	6.5	5.1	4.3	5.3
Industry .....	8.5	6.3	6.6	4.5	5.8
Colleges and universities .....	8.9	11.3	7.7	10.2	9.7
Government agencies .....	4.5	6.7	2.5	3.4	12.6

## Electrical Engineers

### *Annual Rates of Change in Employment of Electrical Engineers*

Sector	Percentage Net Change				
	Actual Change 1959	Forecast			
		1960	1961	1962	Annual Average 1960-62
All Sectors .....	2.8	6.7	4.3	3.4	4.8
Industry .....	2.5	5.9	4.2	3.5	4.5
Colleges and universities .....	9.4	15.9	14.3	8.5	12.9
Government agencies .....	4.6	13.7	2.8	1.7	6.1

## Geological Engineers

### *Annual Rates of Change in Employment of Geological Engineers*

Sector	Percentage Net Change				
	Actual Change 1959	Forecast			
		1960	1961	1962	Annual Average 1960-62
All Sectors .....	1.0	*	2.4	1.9	1.4
Industry .....	-0.5	- 1.7	1.2	1.2	*
Colleges and universities .....	10.4	1.9	11.1	5.0	6.0
Government agencies .....	6.5	15.2	2.6	5.1	7.6



## Mechanical Engineers

### *Annual Rates of Change in Employment of Mechanical Engineers*

Sector	Percentage Net Change				
	Actual Change 1959	Forecast			
		1960	1961	1962	Annual Average 1960-62
All Sectors .....	5.2	8.7	6.1	4.8	6.5
Industry .....	4.7	8.5	5.9	4.8	6.4
Colleges and universities .....	14.3	10.7	11.8	9.6	10.7
Government agencies .....	10.4	10.3	6.0	1.3	5.9

## Metallurgical Engineers

### *Annual Rates of Change in Employment of Metallurgical Engineers*

Sector	Percentage Net Change				
	Actual Change 1959	Forecast			
		1960	1961	1962	Annual Average 1960-62
All Sectors .....	5.5	11.4	4.5	4.6	6.8
Industry .....	4.3	11.2	4.4	3.9	6.5
Colleges and universities .....	23.6	19.1	4.9	14.1	12.7
Government agencies .....	5.3	5.1	4.8	1.5	3.8

## Mining Engineers

### *Annual Rates of Change in Employment of Mining Engineers*

Sector	Percentage Net Change				
	Actual Change 1959	Forecast			
		1960	1961	1962	Annual Average 1960-62
All Sectors .....	5.7	5.6	1.9	2.5	3.3
Industry .....	6.3	3.8	1.8	1.8	2.5
Colleges and universities .....	-3.1	38.7	2.3	12.5	17.8
Government agencies .....	3.9	3.8	3.7	1.2	2.9



# SCIENTIFIC FIELDS

## Biologists

### *Annual Rates of Change in Employment of Biologists*

Sector	Percentage Net Change				
	Actual Change 1959	Forecast			
		1960	1961	1962	Annual Average 1960-62
All Sectors .....	7.0	6.8	5.3	5.1	5.7
Industry .....	15.9	2.4	1.6	1.6	1.9
Colleges and universities .....	8.6	9.7	4.9	5.5	6.7
Government agencies .....	3.1	5.4	7.0	5.7	6.0

## Chemists

### *Annual Rates of Change in Employment of Chemists*

Sector	Percentage Net Change				
	Actual Change 1959	Forecast			
		1960	1961	1962	Annual Average 1960-62
All Sectors .....	4.5	5.4	6.3	2.5	4.7
Industry .....	3.9	5.7	6.4	2.0	4.7
Colleges and universities .....	18.4	7.0	9.1	8.3	8.1
Government agencies .....	2.4	3.3	4.6	2.5	3.5

## Geologists

### *Annual Rates of Change in Employment of Geologists*

Sector	Percentage Net Change				
	Actual Change 1959	Forecast			
		1960	1961	1962	Annual Average 1960-62
All Sectors .....	0.9	5.9	2.7	2.0	3.5
Industry .....	*	6.5	1.8	1.4	3.2
Colleges and universities .....	7.0	6.5	7.1	6.7	6.8
Government agencies .....	*	3.7	3.5	1.5	2.9



## Mathematicians

### *Annual Rates of Change in Employment of Mathematicians*

Sector	Percentage Net Change				
	Actual Change 1959	Forecast			
		1960	1961	1962	Annual Average 1960-62
All Sectors .....	5.3	9.6	11.0	7.2	9.3
Industry .....	0.9	7.1	9.8	7.2	8.0
Colleges and universities .....	11.2	14.0	12.3	7.0	11.1
Government agencies .....	5.3	3.8	11.0	7.7	7.5

## Physicists

### *Annual Rates of Change in Employment of Physicists*

Sector	Percentage Net Change				
	Actual Change 1959	Forecast			
		1960	1961	1962	Annual Average 1960-62
All Sectors .....	3.6	8.8	6.8	5.2	6.9
Industry .....	*	7.1	9.5	7.8	8.1
Colleges and Universities .....	12.7	10.6	8.6	7.4	8.9
Government agencies .....	3.2	9.3	4.5	2.7	5.5

## Forestry Scientists (and Engineers)

### *Annual Rates of Change in Employment of Forestry Scientists*

Sector	Percentage Net Change				
	Actual Change 1959	Forecast			
		1960	1961	1962	Annual Average 1960-62
All Sectors .....	3.0	5.6	3.8	1.9	3.8
Industry .....	4.1	2.2	1.4	0.9	1.5
Colleges and universities .....	6.4	4.0	3.8	1.9	3.2
Government agencies .....	1.4	10.1	6.5	3.1	6.6



## Agricultural Scientists (and Engineers)

### *Annual Rates of Change in Employment of Agricultural Scientists*

Sector	Percentage Net Change				
	Actual Change 1959	Forecast			
		1960	1961	1962	Annual Average 1960-62
All Sectors .....	4.0	3.7	2.1	2.1	2.6
Industry .....	9.5	5.1	2.0	4.8	4.0
Colleges and universities .....	5.3	3.1	5.2	3.5	3.9
Government agencies .....	3.2	3.6	1.8	1.6	2.3

## OTHER PROFESSIONS

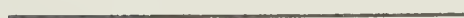
### Architects

#### *Annual Rates of Change in Employment of Architects*

Sector	Percentage Net Change				
	Actual Change 1959	Forecast			
		1960	1961	1962	Annual Average 1960-62
All Sectors .....	9.8	12.2	5.5	2.1	6.6
Industry .....	8.7	13.6	5.7	3.2	7.5
Colleges and universities .....	8.2	9.4	5.2	1.6	5.4
Government agencies .....	12.1	10.8	5.3	*	5.5



# A P P E N D I X





# 1960

## BIENNIAL SURVEY OF REQUIREMENTS FOR PROFESSIONAL PERSONNEL IN SCIENTIFIC AND TECHNICAL FIELDS

Scientific and technical manpower today is basic to our economic growth and national security. It is therefore essential that information be obtained which will help in assessing current and future trends in requirements for professional personnel in scientific and technical fields in the light of changing supplies, and such is the purpose of this survey. The information is needed by industry, professional associations, universities, governments and other groups concerned with the demand for scientific and technical personnel; and by students and vocational counsellors to extend their knowledge of opportunities in these fields.

### Explanatory Notes

**Section 1** is designed to obtain estimates of your requirements for professional personnel in scientific and technical fields for the next three years, and to determine how your prospective requirements compare with recent trends. Your estimates for 1960-62 should be based on your present plans and expectations. It is recognized, of course, that unforeseen circumstances necessarily make your estimates tentative.

**Section 2**, concerning recruitment difficulties, is divided into two parts. The first part is intended to obtain information on the specific fields in which professionals have been or are expected to be in short supply. The second part is designed to assess the effects of any shortages of scientific and technical personnel on the operations or activities of Canadian industry, universities, and governments. Such effects are difficult to measure, but a statement outlining the impact of any existing shortages on your operations will be most helpful.

**Section 3** is designed to determine the major sources from which Canadian employers obtain professional personnel in scientific and technical fields.

**Section 4** is intended to facilitate the processing and analysis of the survey returns.

THE INFORMATION FURNISHED BY YOU WILL BE REGARDED AS CONFIDENTIAL  
AND FIGURES FROM INDIVIDUAL ORGANIZATIONS WILL NOT BE DISCLOSED

*Conducted by*  
Economics and Research Branch, Canadian Department of Labour  
*with the assistance of*  
Executive and Professional Section, NES, Unemployment Insurance Commission

LER 61-0



1. ESTIMATE OF YOUR REQUIREMENTS

How many persons doing professional work of a scientific or technical nature did you employ at December 31, 1958, at December 31, 1959, and how many do you expect to employ at the same date in each of the next three years?

Include only personnel employed in jobs requiring professional competency in scientific or technical fields. These will include:  
(1) those with university degrees,  
(2) members of recognized professional organizations,  
(3) others doing scientific or technical work at a professional level.

Class	Number You Employed		Number You Expect to Employ		
	at December 31, 1958	at December 31, 1959	at December 31, 1960	at December 31, 1961	at December 31, 1962
Engineers:					
Aeronautical .....					
Chemical .....					
Civil .....					
Electrical .....					
Geological .....					
Mechanical .....					
Metallurgical .....					
Mining .....					
Other (please specify):					
.....					
.....					
Biologists .....					
Chemists .....					
Geologists .....					
Mathematicians (incl. actuaries) .....					
Physicists .....					
Architects .....					
University-trained specialists in:					
Forestry .....					
Agriculture .....					
Other (please specify)*:					
.....					
.....					
.....					
.....					
.....					

\*Intended to cover only personnel in such fields as are related to those listed above. Omit, e.g., lawyers, medical doctors, economists, accountants, draftsmen, etc.



2. RECRUITMENT DIFFICULTIES

Regard as "recruitment difficulties" either the necessity for special recruiting efforts to find persons with suitable qualifications, or the failure to fill positions after approximately three months of active recruitment.

A

Over the past year, have you hired or tried to hire any personnel for professional work of a scientific or technical nature?  
..... (Yes or No)

IF YES:

Have you had difficulties (see box) in filling any of these positions?  
..... (Yes or No)

IF YES: Please check the group(s) where you had difficulty in filling your position(s).

During the next three years, do you expect to hire any personnel for professional work of a scientific or technical nature?  
..... (Yes or No)

IF YES:

Do you expect difficulties (see box) in filling any of these positions?  
..... (Yes or No)

IF YES: Please check the group(s) where you expect to have difficulty in filling your position(s).

Engineers:	
Aeronautical .....	
Chemical .....	
Civil .....	
Electrical .....	
Geological .....	
Mechanical .....	
Metallurgical.....	
Mining .....	
Other (please specify) .....	
.....	
Biologists .....	
Chemists .....	
Geologists .....	
Mathematicians(incl.actuaries)	
Physicists .....	
Architects .....	
University-trained specialist in:	
Forestry .....	
Agriculture .....	
Other (please specify):	
.....	
.....	

Engineers:	
Aeronautical .....	
Chemical .....	
Civil .....	
Electrical .....	
Geological .....	
Mechanical .....	
Metallurgical .....	
Mining .....	
Other (please specify) .....	
.....	
Biologists .....	
Chemists .....	
Geologists .....	
Mathematicians (incl.actuaries)	
Physicists .....	
Architects .....	
University-trained specialists in:	
Forestry .....	
Agriculture .....	
Other (please specify):	
.....	
.....	

B

Answer only if you had recruitment difficulties in the past year.

Were your recruitment difficulties in the past year serious enough to affect the operations or plans of your organization? ..... (Yes or No)

IF YES: Please explain briefly the effect which these difficulties had upon your operations or plans




3. YOUR SOURCES

Approximately how many of the persons whom you now employ in professional work of a scientific and technical nature have you hired in the past year?

Approximately how many of these were, at the time you hired them:

- New university graduates .....
- Experienced Canadian professional persons .....
- Recent immigrants to Canada .....
- Obtained outside Canada through active recruitment .....
- Other (please specify): .....

Apart from the hirings referred to above, have you upgraded in the past year to professional work of a scientific and technical nature any of your sub-professional staff?..... (Yes or No) IF YES, how many?

- Approximately how many of these became qualified for professional work in your organization:
- Through work experience and demonstrated ability .....
  - By obtaining a university degree .....
  - By obtaining membership in a professional association .....
  - (without a university degree) .....
  - In other ways (please specify): .....

4. YOUR ORGANIZATION

Name of firm or organization.....

Address.....

Approximate number of all employees, including non professional and technical personnel, as at December 31, 1959:

If your organization consists of more than one establishment or agency, please indicate below which establishments are covered by this return:

.....	<input type="checkbox"/>
.....	
.....	
Establishments not covered:.....	<input type="checkbox"/>
.....	

Date..... Name of person answering questionnaire.....

Please return the completed form as soon as possible to:..... Official position.....

Economics and Research Branch,  
Department of Labour,  
Ottawa 4, Ontario.

The tabulated results of this survey will be available to all respondents requesting them. If you wish to receive a copy please indicate below.  
Yes ☐ No ☐



















